Space Weather Technical Forecast

Issued on Thursday, 07 April 2022 at 13:24 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1/Minor Geomagnetic Storms on day 3 (9th April) due to possible CME arrival and/or coronal hole influences. Active high energy electron fluence easing.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, with a few minor C-class flares. There are currently three sunspot regions on the visible disc. AR2978 (Cho/Beta), in the southwest, is the largest region on the disc. It has shown some signs of decay losing its intermediate spots and it has remained relatively stable with no noteworthy activity. AR2981 has decayed and has lost the spots in its trailing group. It is now classified Bxo/Beta. AR2985 has developed penumbra at both ends and is now classified Dsi/Beta.
No Earth-directed CMEs have occurred in the last 24 hours, although there are a number of filaments visible on the Earth-facing disc that are being monitored for any potential eruption.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, has been at background to slightly elevated levels, reaching a peak of 466 km/s at 07/0510 UTC. The solar wind density was below average (<5 ppcc) before increasing to average values (5-10 ppcc). The interplanetary magnetic field (IMF) strength, Bt, was weak, below 8nT, with the north-south component between -7 and +5 nT, but spent much the period in a negative (southward) direction. The Phi angle was mainly negative (towards the Sun). Geomagnetic activity was Quiet to Unsettled (Kp1-3) with Active (Kp4) intervals 07/0300-0600 UTC and 07/0900-1200 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (10MeV) measured at GOES-16 at GEO was at background levels. The high energy (greater than 2MeV) electron flux was at Moderate to High levels, with a peak of 3830 pfu at 06/1615 UTC. The 24-hour integrated fluence has been slightly above the Active threshold throughout with a gradual rising trend. 1.42e8 integrated pfu was recorded at 07/0000 UTC.

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Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be predominantly Low to Very low, with only relatively small and simple sunspot regions currently on the disc.

Solar Wind / Geomagnetic Activity: The slightly elevated solar winds are expected to ease to mainly background later on day 1 (7th April). These will last until day 3 (9th April), when the arrival of the fast wind of coronal hole 72 is expected, also there is a slight chance of a glancing interaction from a further CME which left the Sun around 04/2200 UTC, although this is very low confidence. Geomagnetic activity is forecast to be Quiet to Unsettled on days 1 and 2 (7th and 8th) with a chance of further Active intervals, before a further enhancement to Unsettled to Active, with a chance of G1/Minor Storms occurs on day 3 (9th), this may extend into day 4 (10th April).

Energetic Particles / Solar Radiation: The high energy (greater than 10MeV) proton flux is expected to persist at background levels, with only a very slight chance of slight increases. The high energy (greater than 2 MeV) electron flux has been diurnally varying between Moderate to High but is expected to ease to mainly Background to Moderate on day 2 (8th). Whilst a recovery in values is possible later in the period, this is likely to be to lower levels than currently observed. The associated 24 hour fluence is currently Active, but expected to fall below this level through day 1 or 2 (7th-8th) and remain below for the rest of the period. There is low confidence in this forecast due to the uncertainty surround the CME arrival and/or CH fast wind arrival on day 3 (9th).

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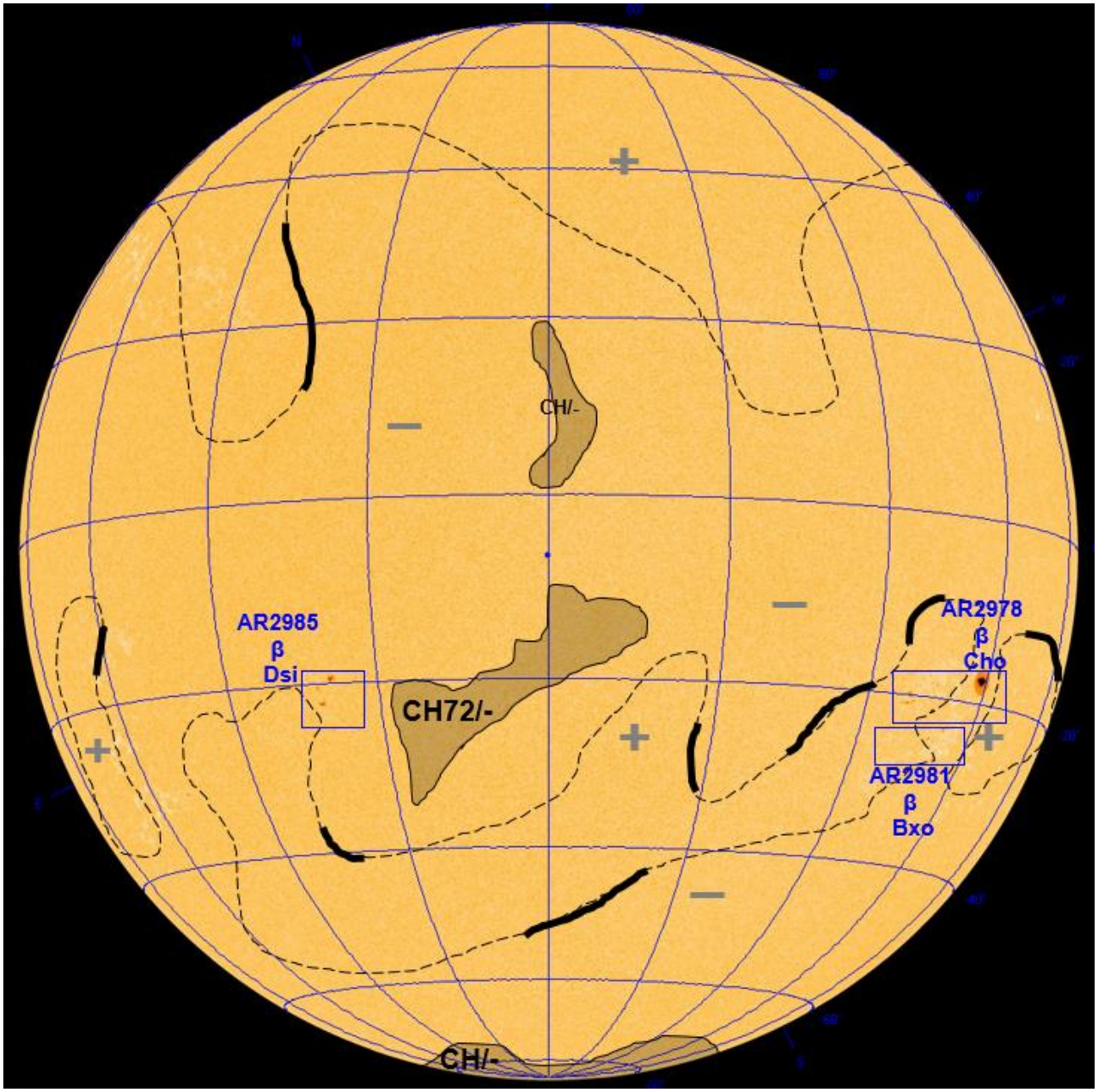
Figure 1. Solar Analysis Valid 07/0700UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Solar winds are expected to be at background to slightly elevated, with the next coronal hole enhancement anticipated during the second half of day 3 (9th), from the arrival of the fast wind of CH72/-. Elevated solar winds are expected to continue through day 4 (10th).

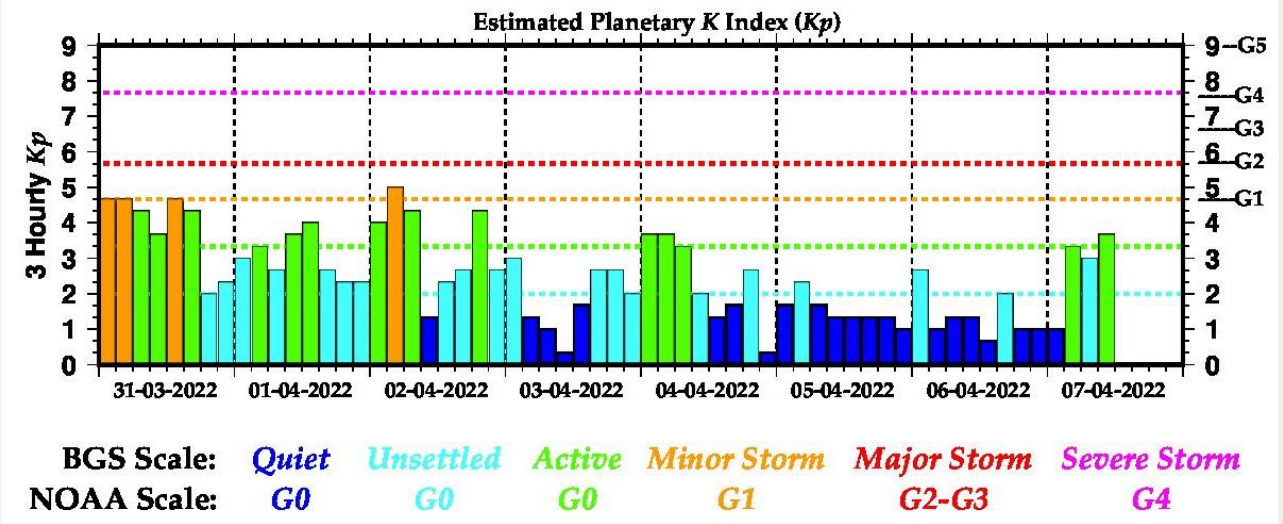
Geomagnetic activity is forecast to be Quiet to Unsettled on day 1 and 2 (7th-8th), with a chance of Active intervals before a further enhancement to Unsettled to Active levels is likely later on day 3 (9th) into day 4 (10th) as CH72/- moves into a geoeffective position. There is also a chance of G1/Minor Storming during the CIR and initial onset of the high speed stream.

A CME which had been assessed as potentially arriving on day 3 (9th) has now been reassessed as likely missing, passing mostly to the south and east of the Earth. There remains uncertainty with this analysis however, and a glancing interaction cannot be ruled out during the later part of day 2 (8th) into day 3 (9th).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	20	40	20
Strong	G3	No	2	2	2	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections- Nil

Figure 2: BGS Estimated Planetary K Index (Kp) shows the recent increase to Unsettled to Active.



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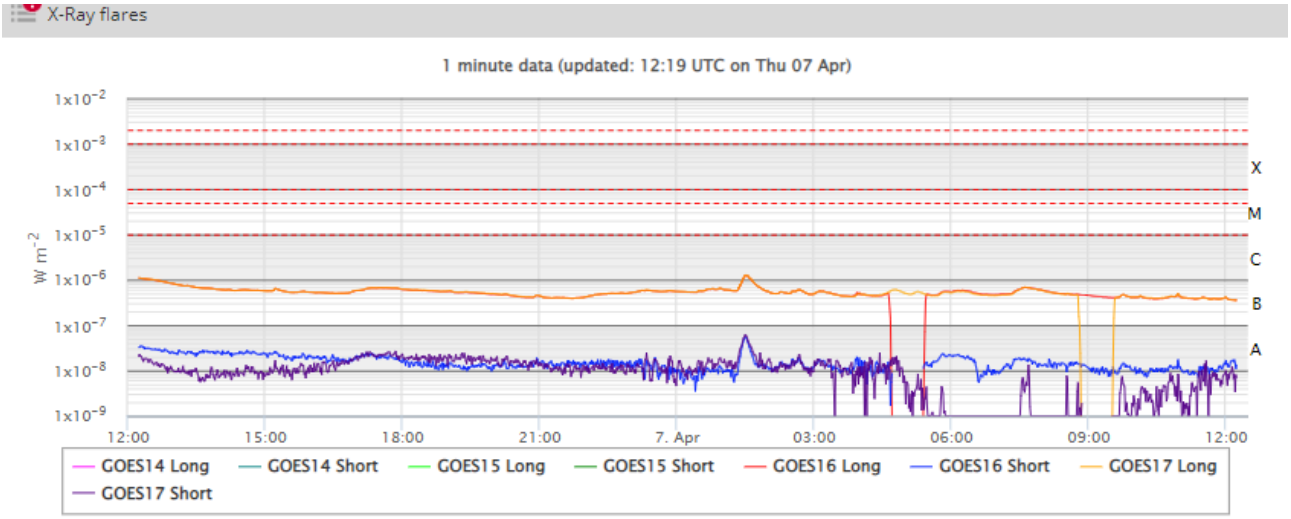
Radio Blackouts - X-Ray Flares:

Solar activity is currently Low, with three sunspot regions on the disc. The largest of these is AR2978 (Cho/Beta), in the southwest, which has grown longitudinally but remains stable. Solar activity is expected to be Low or Very Low over the coming four days. There is a slight chance of it increasing to Moderate levels with isolated M-class flares. AR2978 is the most likely source of this activity, therefore the risk reduces later in the period as this region rotates round the western limb.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	10	10	5	2
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES16 X-Ray flares show little activity.



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Solar Radiation Storms - (High Energy Protons):
The high energy proton flux (greater than 10 MeV) as measured by GOES-16 at GEO is at background levels. It is expected to remain at this level during the forecast period, but there is a very slight risk of proton storms as AR2978 (currently the most complex sunspot region on the visible disc) rotates towards the west limb, and EX2975 and EX2976 (known proton sources) continue to rotate away from the limb on the far side.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	2	2	2	1
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV), as observed by GOES-16 at GEO, has eased back to Moderate levels and is expected to persist at similar levels through the period. However, the arrival of the fast wind of CH72 may result in an increase in flux vales on day 3 (9th).

The associated 24 hour electron fluence is currently Active (above 1e8 pfu), but expected to fall below during day 1 (7th). Although temporary rises are possible thereafter, they aren't thought to be large enough to breach the Active threshold.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	100	40	30	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: GOES16 Electron Flux shows a decreasing trend over the past 3 days.

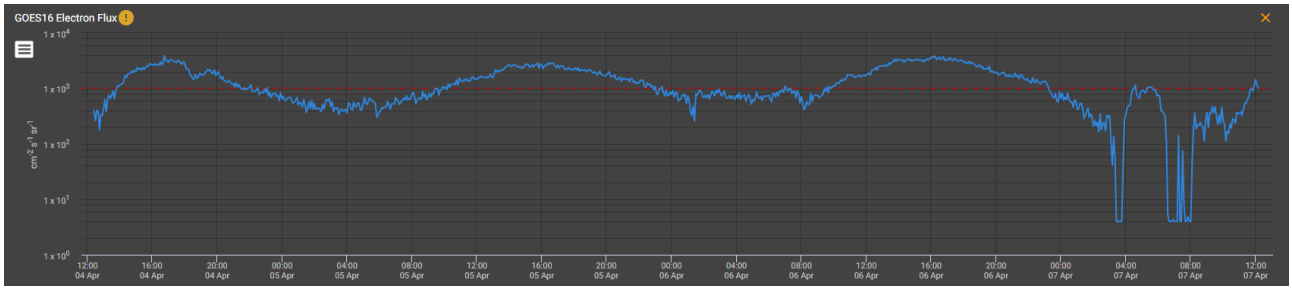
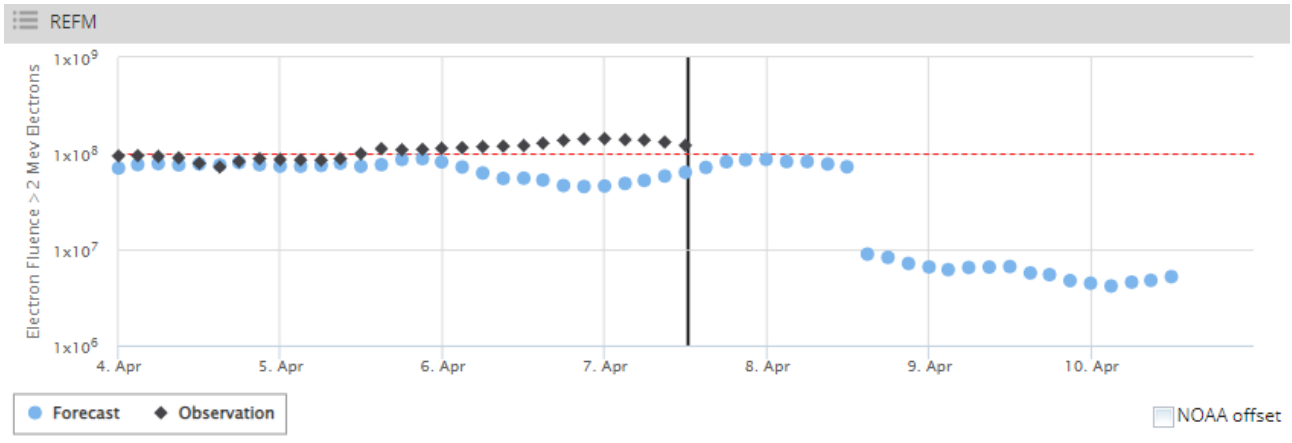


Figure 5: Fluence levels are expected to start to decrease.



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